would then be separated through the hot cut procedure from the other loops and then connected to the d e r ' s facilities in collocated space. At that juncture, the competitor would again convert the analog signal on that loop to digital format and transport it over a DLC to its switch It is obviously inefficient to perform all of the conversions needed to enable a competitor to obtain access to individual loops, and the cost of the additional conversions may make it prohibitively expensive to provide service.

17. Thus, regardless of whether a voice-grade loop is connected to a DLC or terminates directly to the ILEC central office, customers that wish to change to a local carrier that uses its own switch must endure a difficult process that necessarily requires extensive manual work to the customer's existing facilities and that often results in more expensive and/or lower quality service.

. B. <u>ELP Architecture Would Permit Customers To Chance Local Service Providers Electronically</u>

18. Unlike the current local network architecture, once the ELP architecture has been implemented and communications on both the HFS and LFS portion of the loop are packetized, customers could easily change local carriers electronically without any further changes to the underlying facilities serving the customer.

19. The ELP architecture transforms the loop connection between an end user and the customer's chosen local carrier from a hard-wired physical connection to one that is controlled by software. While the ELP architecture entails incremental investment to modernize the loop plant, it leverages existing investments already made by incumbent LECs and competitive local carriers Notably, ELP functions with existing copper distribution loop plant and with existing circuit switches. In addition, customers generally will retain theii existing customer premises equipment, inside wire, and network interface devices.

Electronic Loop Provisioning (ELP)

May 2002

Background

• As they exist today, end-user loops are generally hardwired from the customer premise to their local network service provider—e.g. to the ILEC's Main Distribution Frame (MDF) or from a Digital Loop Carrier (DLC) at the ILEC Remote Terminal (RT) directly into the ILEC's End Office Switch.

• End-user migration from one facilities-based LEC to another requires that the underlying loop facilities be physically re-terminated to different equipment each and every time an end-user wishes to select a different local service provider. This is in addition to all the peripheral tasks needed to support and coordinate the existing hot-cut process.

• DLC and NGDLC deployment in the local loop complicates LEC access to loops, requiring, when technically feasible and cost effective, outside plant work in addition to the traditional CO hot-cut work.

• ELP redefines the end-user-to-local service provider relationship from one that is physically hardwired to one that is software defined.

• As a result, ELP allows end-user migration among LECs can be managed through OSS—there is no need for manual / physical retermination of loops each and every time an end-user wishes to migrate among competing LECs.

O

Background (cont.)

• ELP is ultimately achieved via upgrading and deploying new equipment in the local network that supports packet technology—more specifically, ATM.

• The ELP capability is highly analogous to 1980s FGD Equal Access implementation and the associated PIC process – both allow efficient and virtually unconstrained end-user migration among competing carriers via a software defined architecture and computer controlled change process.

• The existing hot-cut process (even if operating at best-in-class standards) is incapable of supporting mass-market competition, but is nonetheless necessary until the hardwired-linkage of customers to their local carrier is replaced by ELP or its equivalent.

• ELP is a logical and efficient extension of the ILECs' current plans for evolving the local network to NGDLC. ILECs in general, and Verizon in particular, have publicly announced plans to "packetize" data communications at the RT. ELP modifies those plans **so** that all communications signals on a customer's loop are packetized at the same time **(Le.,** "true" NGDLC). This approach has a number of advantages, not the least of which is that it promotes facilities-based local competition for both voice and data communications.

Why ELP ? Why Now ?

• The existing hot-cut process for DLC and non-DLC loops is costly, inefficient, prone to error and has capacity constraints that ultimately cannot support mass-market entry (either small business or residential), even if all other issues were resolvable.

• Although an improved "project-oriented" approach to the existing hot-cut process has yielded better results for existing volumes, it too is insufficient to sustain a robustly competitive facility-based market.

• If mass market competition based primarily on UNE-L is a public policy and commercial objective, then a plan to transition from a manual to an electronic loop provisioning system must be designed and implemented.

• No manual system will be reliable enough, cost-effective enough, or capable of supporting mass-market migration and chum volumes in order to achieve the type of competition desired.

• The NY Commission has recognized this latter point in its initial comments to the FCC in the Triennial Review of UNEs—noting that hot-cut performance would have to improve -4400% in order to migrate existing ***NY*** UNE-P customers to UNE-L and that it would take 11+ years to do **so** under the volumes currently supported via the hot-cut process.

Why ELP ? Why Now ? (cont.)

- If there is to be sustainable facilities-based mass-market competition, the establishment **of** an architecture and migration process that can support mass end-user UNE-L migration among **LECs** is necessary.

- The evolution of the local network towards a DLC loop architecture complicates loop migrations among LECs — both a facility transfer to copper and a hot cut must occur together.

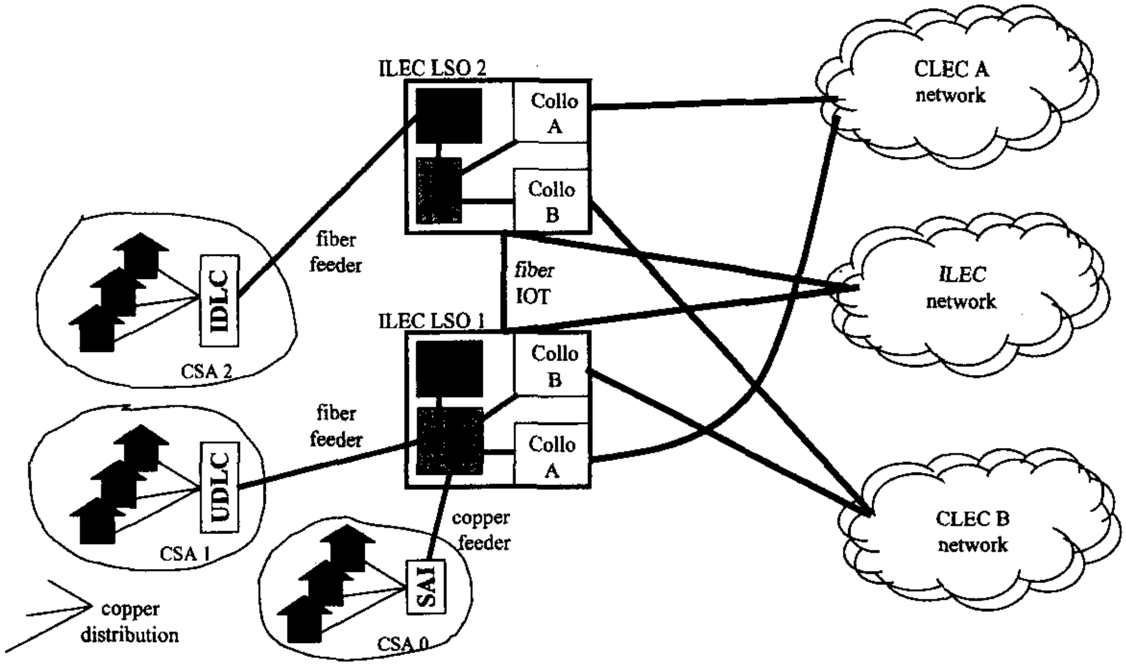
- Such a network architecture limits UNE-L opportunities.

- ELP *is* not an independent objective – rather, it is a modified version of the evolutionary approach to the network that is already being pursued. The question is not whether to packetize the network but how and how much of it to do.

ELP Benefits

Benefit(s)	Consumers	ILECs	CLECs
Software defined connections between end-users and local service providers	X	X	X
Promotes the deployment of advanced services infrastructure to all end-users.	X	X	X
Reduces the need of staff and resources needed to support a manually intensive migration process (e.g. existing hot-cut process).		X	X
Reduces the presence of "outside" technicians at the ILEC LSO thereby mitigating certain ILEC security concerns.		X	
Reduces CLEC collocation space requirements (thereby reducing collocation costs and contributing positively to any LSO collocation exhaust issues) by reducing the need of DLC deployment in those cages.		X	X

The Existing Local Network Architecture



ELP and its Impact on the Local Network Architecture

- The ELP architecture impacts the existing local network in three areas :
  - Outside Loop Plant. This is the portion of the network that is located outside of the ILEC CO up to the end-user premises. It encompasses the ILEC's distribution facilities, SAI, RT, and feeder facilities to the ILEC Central Office (CO).
    - Key upgrade = tNGDLC equipment that packetizes all end-user communications and connects a copper facility serving the end user premises with a fiber facility routed to the service network.
  - Central Office. This is the ILEC "building" that typically houses the end-office switch and MDFs on which the ILEC's outside plant terminate.
    - Key upgrade = an ATM module is deployed to which all sub-tending tNGDLC equipment is connected and to which all LECs will interconnect for access to the "loops" serving their retail customers. ATM module is analogous to CO OCD equipment being deployed by the ILECs in their NGDLC architectures. Under ELP, the ATM module functions as an "electronic" MDF.

ELP and its Impact on the Local Network Architecture (cont.)

- PSTN interface. This refers to the deployment of equipment that will apply to both the ILEC and CLECs electing to provide voice services using a circuit switched architecture.

  - Key upgrade = **VoATM** gateways that will "translate" traffic between the packet-based ELP architecture and a LEC's traditional, circuit switched network (e.g. Class 5)

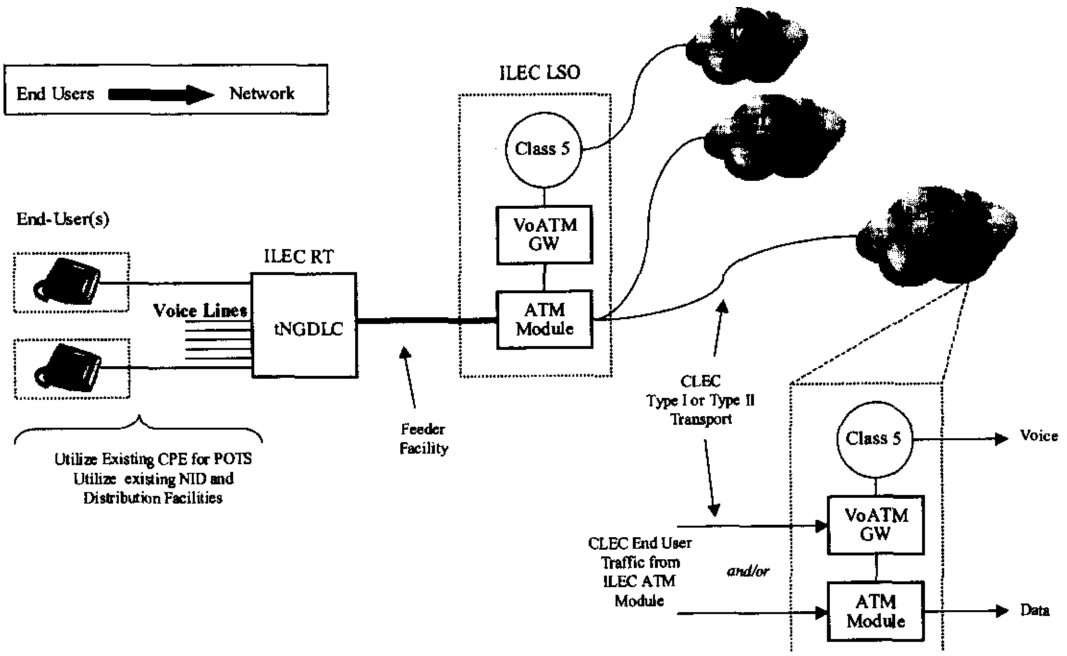
- Outside of these three key upgrades, the ELP architecture preserves much of the existing local network investment :

  - CPE remains unchanged for voice services. Compatible CPE needed **for** advanced services (e.g. high-speed **data,** derived voice lines, etc.) are also unchanged.

  - Distribution facilities (e.g. copper) from **NID** to RT remain unchanged.

  - Fiber feeder facilities, between RT and CO, remain unchanged.

General ELP Network Architecture Diagram



Note : The ELP architecture can be designed and engineered in several different ways. This is a general illustration of the ELP architecture / flow through.

ELP Technology and Network Architecture - tNGDLC

- **tNGDLC at the ILEC RT**

  • Digitizes and packetizes all end-user communications traffic (voice and data) sent to the ILEC CO, not just data traffic as with existing ILEC NGDLCs. End-user communications are converted to ATM cells.

  • ATM cells are converted back to analog format for transmission to the end-user. As a result, existing CPE can continued to be used.

  • Manages the transfer of ATM cells over fiber feeder facility to the ILEC CO.

  • ATM protocol allows for the establishment of Permanent Virtual Circuits (PVCs) between the end-user and the local service provider

ELP Technology and Network Architecture – tNGDLC (cont.)

- **tNGDLC at the ILEC RT (cont.)**
  - ATM technology is fundamental to ELP
    - ATM protocol allows for the establishment of Permanent Virtual Circuits **(PVCs)** between the end-user and the local service provider
    - ATM cells contain header information, which among other things, allows PVCs to be established
    - Implementation of ATM technology to **an** end-user's voice (and data) communications traffic replaces the existing hardwired linkage to the service network with a software defined linkage

ELP Technology and Network Architecture – ATM Module

- <u>**ATM Module at the ILEC CO**</u>

  - Termination point for sub-tending RT feeders
  - Serves **as** a multiplexer that allows the RT electronics and feeder facilities to be shared among multiple LECs
  - Serves as the point of demarcation between the ILEC's loop plant and the networks of all LECs, including the incumbent
  - Each LEC would be assigned " X number **of** physical **ports** (e.g. DS1, DS-3, OC-3, etc.) on the ATM module, to which its end-users traffic would be routed
  - ATM technology allows for the easy migration of **an** end-user's traffic from one LEC port to another—no physical changes, just ***OSS*** command(s)
  - Carrier changes are made by redefining PVCs — instead **of Port A,** traffic is routed to Port B, eliminating any need for physical re-wiring

ELP Technology and Network Architecture – VoATM GW

- **VoATM Gatewav**

  - Necessary for voice traffic to be handled by the traditional circuit-switched network (e.g. Class 5 network)

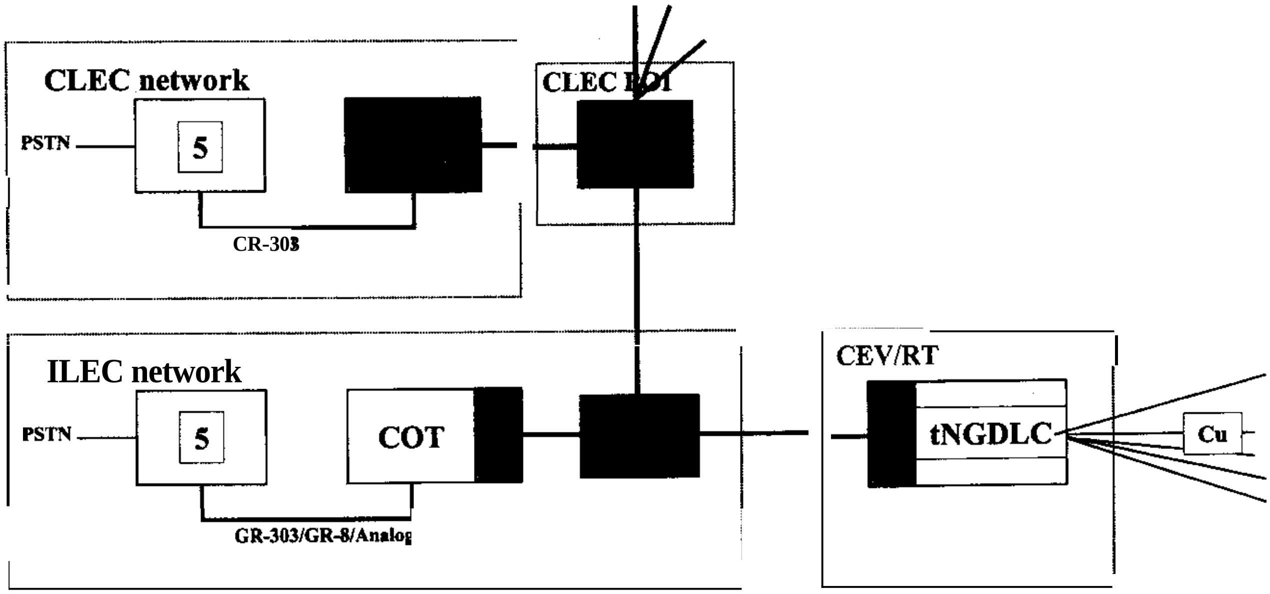
  - Translates between the traditional circuit-switched network (e.g. Class 5 network) and an ATM-based transport facility

  - Translates ATM cells into TDM-based voice traffic, and vice versa

  - VoATM Gateways preserve existing investments in circuit-switched networks

  - VoATM Gateways permit the utilization of all Class 5 features

Evolving the Voice Network Architecture



VPP-Voice Packet Processor

•ATM Module already in ILEC network needed for unbundling ADSL data

Incremental Needs for tNGDLC

Incremental Needs

- Voice Packet Processor at the ILEC RT, ILEC CO. and CLEC GW – This function will need to be provided by the ILEC COT, tNGDLC and the CLEC VoATM gateway. This device could be a card for existing DLC equipment, an external box or a replacement gateway. tNGDLC gateways equipped with a VPP capability are available from multiple vendors today.

- ATM Capacity - ATM modules exist today in ILEC networks for the purpose of providing ADSL data service (e.g., SBC Pronto). Additional PVC capacity and ports will be needed for ELP.

Benefits

- More Efficient Use of Fiber Facilities. Current "NGDLC" equipment (e.g, Alcatel Lightspan 2000) requires separate OC-3/OC-12 fibers for voice and data to carry TDM and ATM respectively. tNGDLC technology will combine all signals on a single OC-3/OC-12 feeder.

- Unbundling of all services provide over both the low an high frequency spectrum.

- Rapid and less error prone cutover.

- No change to CPE for POTS voice service is required.

Conclusions

• If the ultimate objective is to have increased mass-market competition based UNE-L, then some form of electronic loop provisioning must be implemented—hot-cuts alone will not allow such broad-based competition to occur.

• ELP fundamentally transforms the end-user/local service provider relationship from one that is hardwired to one that is software defined. ELP achieves this by migrating end-user loops to "true" NGDLC equipment, packetizing all of an end-user's telecommunications signals into **ATM** cells and creating software defined **ATM** PVCs.

• ELP is incremental to efforts already underway to place loops on NGDLC. ELP leverages that on-going evolution and investment to promote competition by facilitating end-user migration among LECs.

• ELP can be implemented in phases and in conjunction with NGDLC deployment plans. However, this does not preclude the promotion of a more aggressive implementation schedule.

Attachment 1 – Existing Hot-Cut Process

Simplified Hot Cut Process

verizon

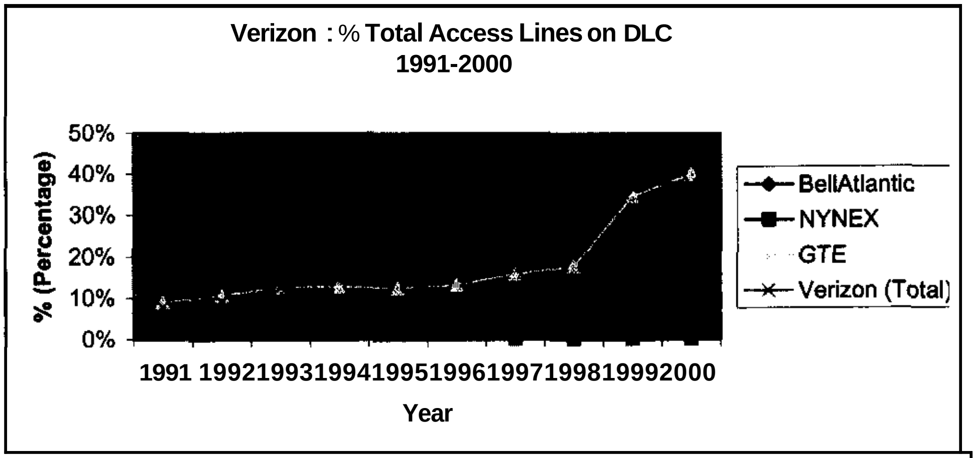
End user wants move	Application Date	Application Date Plus	Due Date Mi	F h Cut Date	Post Fnme Due Time
•End User contacts CLEC looking to move existing service from Verizon to CLEC •CLEC checks CSR for features and other information	•CLEC sends LSR indicating Hot Cut •VZ either queries or accepts and issues LSRC •Hot Cut Order flows to APC (Reuse facilities), RCMAC, RCCC	•RCCC verifies order •RCCC sends WFA / DI tickets to Frame to wire as per FOMS	.VZ LNP Trigger set automatically •Frame verifies off (VZ) and on (CLEC) appearance on MDF •RCCC contacts CLEC only if problems	•RCCC obtains Go / No Go from CLEC, advising Frame of direction •If Go, Frame completes, notifies RCCC who advises CLEC of cut status	•CLEC activates port in NPAC •VZ completes order. eventually pulling translation •CLEC refers post cut troubles to RCMC

Attachment 2 – RBOC DLC Deployment

Company	Total Access Lines (Working Channels)	Total DLC (Copper and Fiber)	% of Access Lines on DLC
Total	196,413,749	57,650,234	29.4%

Source : "Optical Assess – North America : Service Provider Competitive Analysis : BellSouth, Qwest, SBC. and Verizon—Deployment *and Trends for DLC and PON." RHK—Telecommunications* Industry Analysis. December 2001. Note : Data based upon ARMIS *43-01* and RHK Analysis.

Attachment 3 – Verizon DLC Deployment

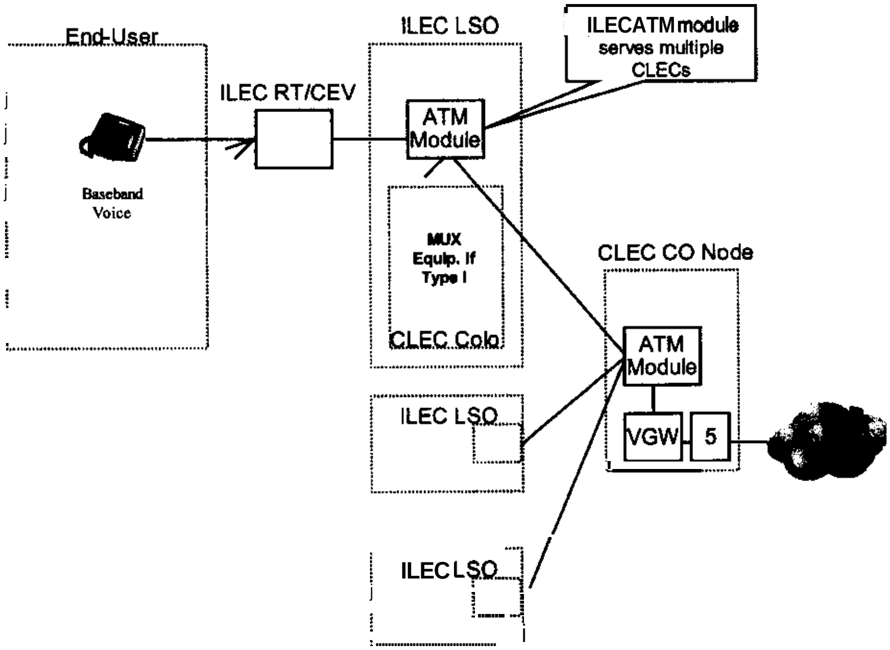


BellAtlantic	9%	11%	18%	21%	25%	29%	24%	35%	38%	37%
NYNEX	5%	6%	7%	9%	13%	12%	.			
GTE	9%	11%	13%	13%	13%	13%	16%	18%	35%	40%
Verizon (Total)	8%	9%	13%	15%	17%	19%	22%	30%	37%	38%

Note : RHK indicates that the '99-'00 numbers reflect DLC systems sold off in certain GTE territories as Verizon consolidated its company holdings.

Source : "Optical Access – North America : Service Provider Competitive Analysis : BellSouth Qwest, SBC, and Verizon—Deployment and Trends for DLC and PON." RHK—Telecommunications Industry Analysis. December 2001. Note : Data based upon ARMIS 43-07 and RHK Analysis.

"UNE-PVC" w/ CLEC Concentration POTS Only Service



Attachment 5 - ELP (POTS+)

"UNE-PVC" w/ ILEC Concentration
POTS, ADSL and VoDSL Service